(19) Europäisches Patentamt
European Patent Office
Office europ´en des brevets

(11) Publication number: **0 317 058 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88308575.5**

(51) Int. Cl.[4]: **A61L 15/00**

(22) Date of filing: **16.09.88**

The title of the invention has been amended (Guidelines for Examination in the EPO, A-III, 7.3).

(30) Priority: **18.09.87 GB 8722004**

(43) Date of publication of application:
24.05.89 Bulletin 89/21

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(71) Applicant: **HERCULES INCORPORATED**
Hercules Plaza
Wilmington Delaware 19894(US)

(72) Inventor: **Bither, Peter Getchell**
2807 Kennedy Road Talleybrook
Wilmington Delaware 19810(US)
Inventor: **Engle, Edward Jacob**
10 Slashpine Circle Southwood
Hockessin Delaware 19707(US)
Inventor: **Ellers, Berne Frederick**
Almliden 34
Orkelljunga(SE)

(74) Representative: **De Minvielle-Devaux, Ian Benedict Peter et al**
CARPMAELS & RANSFORD 43, Bloomsbury Square
London WC1A 2RA(GB)

(54) Absorbent product with hydrophobic liquid transfer layer.

(57) Disclosed is a laminated structure for use in an absorbent product comprising a hydrophobic liquid-transfer layer adjacent to a fluid permeable top sheet, and an absorbent layer. The hydrophobic layer comprises a thermally consolidated blend of 5% to 50% of thermally bondable hydrophobic fibers and 50% to 95% wood fluff pulp.

EP 0 317 058 A1

ABSORBENT PRODUCT WITH HYDROPHOBIC ACQUISITION LAYER

This invention relates to an improved construction for absorbent products having a liquid-permeable top sheet, an absorbent layer, and a liquid-impermeable backing sheet.

Most currently available absorbent products such as baby diapers, feminine hygiene products and adult incontinence pads have an absorbent layer adjacent to the liquid-permeable top sheet, which is referred to as "cover stock", holds the absorbent core in place and also acts as a barrier that permits the flow of body fluid into the absorbent core, but inhibits its flow back towards the skin.

The time required for liquid to penetrate through the cover stock is called the "strike-through" time. A long strike-through time permits body fluids to spread over the cover stock and reach the edges of the product before penetration. In this situation, more of the wearer's skin is exposed to the fluid and the fluid is more likely to leak from the absorbent product. A shorter strike-through time is likely to result in less leakage and a drier, more comfortable feel to the wearer.

"Rewet" is the term used to describe the amount of fluid that flows from the absorbent core back through the cover stock to the wearer's skin, particularly upon application of pressure. Users of products having improved rewet are less likely to experience skin irritation or bed sores.

There is a need for absorbent products with shorter strike-through times and less rewet than currently available products provide.

According to the invention, an absorbent product having a liquid-permeable top sheet, an absorbent layer, and a liquid-impermeable backing sheet, is characterized in that a porous hydrophobic liquid-transfer layer is between the top sheet and the absorbent layer, the hydrophobic layer comprising a thermally consolidated blend of from about 5% to about 50% of a thermally bondable hydrophobic fiber and from about 50% to about 95% of wood fluff pulp, based on the weight of the blend.

Preferably the amount of hydrophobic fiber used in the blend of wood fluff pulp and thermally bondable hydrophobic fiber in the liquid-transfer layer is from about 20% to about 30% of the fiber, based on the total weight of the liquid-transfer layer.

The hydrophobic fiber/wood fluff pulp blend is consolidated by heating at a temperature and for a time sufficient to raise the temperature of the blend to above the melting point of the hydrophobic fiber. For example, the melting point of polyethylene pulp is 132° C, while the melting point of polypropylene pulp is 165° C. Methods used to fuse the hydrophobic fiber are known in the art and include the use of calenders, infrared heaters and pull-through dryers. Exact conditions, which will be readily ascertained by one skilled in the art, must be determined for the specific blend being used. The time, which is also readily ascertained by one skilled in the art, generally ranges from 1 second to about 10 minutes.

The melting of the polyolefin fibers during thermal consolidation of the blend develops a hydrophobic surface and produces pores that are larger than those of the unconsolidated blend, which means that the average pore size of the hydrophobic liquid-transfer layer after thermal consolidation is also greater than the average pore size of the conventional, unconsolidated absorbent layer, thus exploiting the tendency of a liquid to flow spontaneously from a layer containing large pores (the hydrophobic layer) to an adjacent layer having smaller pores (the absorbent layer). The wicking of absorbed liquid back to the top sheet is therefore minimized and rewet is lower. The greater the concentration of synthetic pulp, the larger the pores and the more hydrophobic the surface of the liquid-transfer layer.

Also preferably, a highly absorbent, nonwoven cellulosic tissue is positioned between the hydrophobic liquid-transfer layer and the absorbent layer. Such tissue, commonly used in the manufacture of facial tissues, toweling and napkins, is a fine pore, high density material that further exploits the tendency of a liquid to spontaneously flow from a layer containing large pores (the hydrophobic layer) to an adjacent layer having smaller pores (the tissue layer), and thus increases the driving force that pulls the fluid through the hydrophobic layer. The effectiveness of the hydrophobic layer depends upon the strength of that driving force.

The cellulosic material is wood pulp made by either the sulfite or the sulfate process. The tissue is made on a dry creped wadding machine where the material is creped to impart elongation, typically 12% to 20% in the machine direction. This type of material generally does not contain any chemical additives such as debonding agents or surfactants.

An alternative preferred expedient for increasing the driving force can be provided by incorporating a "superabsorbent" in the conventional absorbent layer, thus exploiting the strong affinity of the "superabsorbent" for liquids. The "superabsorbent" that can be used in the absorbent layer is a water-swellable, water-insoluble polymeric absorbent material and includes cross-linked polyacrylates, cross-

linked sulfonated polystyrenes, cross-linked poly-(alkylene oxides) and graft copolymers of water-insoluble polysaccharides such as starch and cellulose. The polymeric absorbent is normally in the form of a fiber or powder. Such materials are well known in the art, for example, from U.S. patents 3,669,107, 3,670,731 and 4,235,237.

The thermally bondable hydrophobic fiber in the hydrophobic liquid-transfer layer can be a cut staple fiber such as fibers of polypropylene or polyethylene or copolymers thereof, or polyolefin pulp such as polypropylene or polyethylene pulp. A polyolefin pulp is preferred. Such pulps are well known in the art, for example, from "Pulp, Synthetic," Kirk-Othmer, Encyclopedia of Chemical Technology, 3rd Ed. (New York: 1982), Vol. 19, pp. 420-435. The pulps are very fine, highly branched, discontinuous fibrils made from thermoplastic polymers. Their visual appearance and dimensions closely resemble those of wood pulp.

Representative of the polymers from which the polyolefin pulps are made are polyethylene, polypropylene, copolymers of ethylene and propylene, copolymers of propylene and other 1-olefins such as 1-butene, 4-methylpentene-1 and 1-hexene. The polyolefin pulps can be composed solely of one of these polymers, or they can be composed of mixtures of two or more of the polymers. The preferred polyolefin pulps are those prepared from polyethylene or polypropylene.

Poly(vinyl alcohol) (PVA) can be used to treat the polyolefin pulp to make it more dispersible in water during sheet formation. If PVA is used, from about 0.2% to about 2% is applied, based on the weight of the polyolefin pulp. PVA-treated polyolefin pulps are available commercially, for example, polyolefin pulps available from Hercules Incorporated as PULPEX® E-D and P-AD. PVA-treated polyolefin pulp is hydrophobic after thermal consolidation.

The wood fluff pulp in the hydrophobic liquid-transfer layer can be a chemical or mechanical pulp derived from either softwoods or hardwoods. Preferably, the amount of wood fluff pulp used is from about 78% to about 80%, based on the total weight of the liquid-transfer layer. The fluff pulp and the hydrophobic fiber are blended by any of the known blending methods. Such methods include the preparation of a pulp sheet by conventional paper-making procedures or bY conventional dry blending methods.

After blending, the spurted polyolefin and wood pulps are fluffed and formed into a fluff pad by conventional methods such as hammermilling or air forming. The polyolefin pulp and wood pulp can also be fluffed prior to blending. The order of fluffing and blending is not critical.

Preferably, after thermal consolidation the density of the hydrophobic liquid-transfer layer is adjusted to between 0.03 and 0.12 g/cc, for example, by passing through a calender. A more preferred density is about 0.04 to about 0.06 g/cc.

The fluff pulp can be made more hydrophobic by treating with from about 0.1% to about 0.5% of ketene dimer. About 0.25%, based on the weight of the wood fluff pulp, is preferred. The ketene dimer can be applied, for example, by spraying it in the form of an aqueous dispersion onto the moving web of the hydrophobic fiber/wood fluff pulp blend before the blend is thermally consolidated.

The ketene dimers that can be used for treating the wood fluff pulp may be those conventionally used for the sizing of paper. In general, ketene dimers have the formula $[RCH=C=O]_2$ where R is a hydrocarbon radical, such as alkyl having at least 8 carbon atoms, cycloalkyl having at least 6 carbon atoms, aryl, aralkyl, and alkaryl. Ketene dimers that could be used in the process of the instant invention include octyl, decyl, dodecyl, tetradecyl, hexadecyl, octadecyl, eicosyl, docosyl, tetracosyl, phenyl, benzyl, beta-naphthyl and cyclohexyl ketene dimers, as well as the ketene dimers prepared from palmitoleic acid, oleic acid, ricinoleic acid, linoleic acid, and linolenic acid, but the preferred treating composition is the alkylketene dimer emulsion sold under the trademark AQUAPEL® 360X and available from Hercules Kemiska AB-Gothenberg, Sweden, more preferably diluted 3:1 with water.

The type of cover stock used is not critical to this invention. Currently available materials are made of fibers including rayon, polyester, polypropylene and wood pulp, which are formed into conventional web or sheet structures by means of various forming and bonding techniques. The finished products include fabrics that may be carded and latex bonded, carded and thermal bonded, spunbonded, wet-laid or air-laid and bonded, wet formed, spunlaced, or knitted. These materials are available in varying ranges of weight per unit area, thickness, dry and wet tensile strength and stiffness. The fibers from which the cover stock is produced are conventionally surface-treated to render them hydrophilic.

The composition of the absorbent layer is also conventional (unless its absorbancy is enhanced by the inclusion of a "superabsorbent" according to one of the preferred embodiments of the invention, as previously described). The conventional absorbent layer is usually composed mainly of wood fluff pulp, but may additionally contain peat moss, creped wadding, melt blown polyolefin fiber, cut staple fibers of polyolefin, polyester or various nonwoven scrims of cover stock-like material.

The following examples illustrate the invention. The TEFO rewet test used in the examples was developed by the Institute for Textile Research (Sweden) and is conducted as follows. An absorbent product

that has a cover stock layer is placed in the TEFO absorption tester. 1.0% NaCl solution at 8.3 times the sample weight is added under a load of 100 Pa. After two minutes, the sample is removed from the tester and the cover stock is removed. Th cover stock is placed on a steel plate and covered with filter paper. A 20 g weight is placed on the filter paper for two minutes, after which the filter paper is removed and weighed. The references to strike-through time mean the time in seconds required for 5 ml of 1.0% saline solution to be completely absorbed by the sample.

Example 1

RAYFLOC J bleached kraft pulp supplied by ITT Rayonier, Inc. is fed to a hammermill where it is combined with wet fluffed PULPEX® E-D polyolefin pulp (Hercules Incorporated). The combination of polyolefin pulp and wood pulp is then metered via a forming head onto a tissue having a basis weight of 20 grams per square meter (gsm) (Seraccius Paper Company, Finland) at a concentration of 30 to 130 gsm.

The web is then passed through a three section drying tunnel at temperatures of 50° C (zone 1), 150° C (zone 2) and 150° C (zone 3). The density of the web is controlled to about 0.05 g/cc by passing through a calender. The web is stabilized by passing mill air at ambient temperature (23° C) through the web in a cooler. The composition of the web is 20% PULPEX® E-D polyolefin pulp and 80% wood fluff pulp and the basis weight of the thermally bonded hydrophobic layer is 50 gsm.

The commercial products described below are tested for strike-through time and rewet. The combination of the hydrophobic liquid-transfer layer and tissue prepared as described above is then slipped between the cover stock and the absorbent core of the same commercial products and the tests are repeated. The results are given in Table 1. In the table, the commercial products are designated as "standard" and the combination of commercial product plus the hydrophobic liquid-transfer layer of this invention is designated as "new". The commercial products tested are:

(1) Feminine napkin. The product contains about 14 g of fluff pulp and tissue with a 17 gsm carded thermally bonded polypropylene cover stock and a low density polyethylene barrier film backing.

(2) Baby diaper. The product contains 37.5 g fluff pulp, 3.5 g tissue and 4.6 g superabsorbent, and has a 24 gsm carded thermally bonded polypropylene top sheet.

(3) Incontinence pad. The core contains 30% SOLSORB 86 superabsorbent, 18% PULPEX® E-338 polyolefin pulp (Hercules Incorporated) and 52% RAYFLOC J (ITT Rayonier, Inc.). Two plies with a basis weight of 355 gsm were air-laid on a 20 gsm tissue. The cover stock is thermally bonded polypropylene with a basis weight of 16 gsm.

(4) Incontinence brief. The product contains approximately 28% melt blown polypropylene fiber in two layers blended with wood fluff pulp in the top ply, and wood fluff pulp plus superabsorbent powder in the bottom ply next to a barrier film. The top sheet is spunbonded polypropylene.

Table 1

	Strike-Through (sec)		Rewet (g)	
	Standard	New	Standard	New
Feminine Napkin	5.0	4.4	0.130	0.041
Baby Diaper	5.8	3.9	0.068	0.052
Incontinence Pad	4.6	3.8	0.036	0.030
Incontinence Brief	4.0	2.7	0.600	0.220

Example 2

A hydrophobic liquid-transfer layer is prepared as described in Example 1, except that after metering the blend of PULPEX® E-D polyolefin pulp and RAYFLOC J onto the tissue, an emulsion of AQUAPEL® 360X alkylketene dimer emulsion (Hercules Kemiska AB-Gothenberg, Sweden) is diluted 3:1 with water and

sprayed onto the moving web before passing through the drying tunnel. The amount of ketene dimer retained is about 0.2%, based on the weight of the wood fluff pulp.

Claims

1. An absorbent product having a liquid-permeable top sheet, an absorbent layer, and a liquid-impermeable backing sheet, characterized in that a porous hydrophobic liquid-transfer layer is between the top sheet and the absorbent layer, the hydrophobic layer comprising a thermally consolidated blend of from about 5% to about 50% of a thermally bondable hydrophobic fiber and from about 50% to about 95% of wood fluff pulp, based on the weight of the blend.

2. An absorbent product as claimed in claim 1, further characterized in that the amount of hydrophobic fiber used in in the liquid-transfer layer is from about 20% to about 30%, based on the total weight of the liquid-transfer layer.

3. An absorbent product as claimed in claim 1 or 2, further characterized in that the hydrophobic fiber is polyethylene pulp or polypropylene pulp.

4. An absorbent product as claimed in claim 1, 2, or 3, further characterized in that a layer of nonwoven cellulosic tissue is positioned between the hydrophobic liquid-transfer layer and the absorbent layer, or the absorbent layer contains a water-swellable, water-insoluble polymeric absorbent material.

4. An absorbent product as claimed in any of the preceding claims, further characterized in that the wood fluff pulp in the hydrophobic liquid-transfer layer is treated with 0.1% to 0.5% of a ketene dimer, based on the weight of the wood fluff pulp.

5. An absorbent product as claimed in any of the preceeding claims, further characterized in that the density of the hydrophobic liquid-transfer layer is from about 0.03 to about 0.12 g/cc.

6. A method for making an absorbent product as claimed in any of the preceding claims, in which an absorbent layer is positioned between a liquid-permeable top sheet and a liquid-impermeable backing sheet, characterized in that a blend of from about 5% to about 50% of a thermally bondable hydrophobic fiber and from about 50% to about 95% of wood fluff pulp is consolidated by melting the hydrophobic fiber to form a porous hydrophobic liquid-transfer layer and the liquid-transfer layer is positioned is between the top sheet and the absorbent layer.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 88 30 8575

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	GB-A-1 160 625 (MÖLNLYCKE) * Page 1, lines 22-31,69-82; claims *	1-6	A 61 L 15/00
Y	US-A-4 590 114 (D.HOLTMAN) * Column 4, lines 45-58; claims *	1-6	
A	EP-A-0 165 807 (PROCTER & GAMBLE)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

A 61 L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23-12-1988	COUSINS-VAN STEEN G.I.L.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)